DETAILED ACTION

Claim Status

Claims 1-17 are pending.

Claims 1-17 are being examined.

Priority

This application claims priority to Japanese application 2003-048216 filed in Japanese on 21 January 2003 in Japan. Japanese application 2003-048216 does not contain support for limitations to information entropy. Thus, claims 4-9 and 13-15, directed information entropy, are not given benefit to the Japanese application 2003-048216.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 20 August 2004 complies with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered by the examiner.

Drawings

The drawings submitted 20 August 2004 are acknowledged.

Specification

The abstract of the disclosure is objected to because the abstract is longer than 150 words. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-9 and 16 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims are directed to a computer software program product stored on a computer readable memory. The specification does not define the term "computer readable memory". The specification states at p. 6 that the components 7 through 12 are the commands for the computer system, which is comprised of data and a computer software program installed in the memory medium such as a hard disk via another memory medium (CD-ROM, etc.). Giving the claims the broadest reasonable interpretation, a computer readable medium is being interpreted as any computer readable medium. A carrier wave is a medium that is encompassed by the term "computer readable medium". Carrier waves are a natural phenomena and as such are non-statutory. Because the claims encompass subject matter that is not statutory, the claims are rejected.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-3, 10-12, 16, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Angius et al. (Human Genetics, Vol. 111, p. 9-15, 18 June 2002) in view of Abecasis et al. (Bioinformatics, Vol. 16, No. 2, p. 182-183, 2000).

The claims are directed to a computer program and a computer-implemented method comprising a color output that converts linkage disequilibrium (LD) data into color and a comparative display displaying comparative results between two loci in color. In some embodiments, the color of the compared loci is a compounded color.

Angius et al. shows the comparison of loci in color visually demonstrating the linkage between loci. Angius et al. show that the software program GOLD is used to prepare the colored plots (p. 12, col. 1). Angius shows the comparison in compounded colors (p. 11, fig. 2). Angius et al. shows the calculation of LD using the program Multi-locus (p. 12, col. 1). Angius et al. shows the calculation of differences between gene loci (p. 12, col. 1).

Angius et al. does not show a color output to convert linkage disequilibrium values into colors.

Abecasis et al. shows a software program and a computer implemented method of colorizing linkage disequilibrium data, called GOLD. Abecasis et al. shows that linkage disequilibrium values are converted in to colors (p. 183, col.1). Abecasis et al. show that GOLD calculates pairwise disequilibrium measures and provides a graphical overview of the disequilibrium patterns (182, col. 2). GOLD shows the calculation of LD for individual pairs of gene loci (p.183, fig 3). Abecasis et al. shows that it is difficult to draw meaningful conclusions from tables of LD values, whereas graphical representations of the same information are easy to interpret (p. 182, col. 2).

It would have been obvious to modify the analysis of LD of Angius et al. with the color plotting of Abecasis et al. because Abecasis et al. shows that interpretation of LD data is easier in a colored graphical format.

Claims 1, 3-10, and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Angius et al. in view of Abecasis et al. as applied to claims 1-3, 10-

12, 16, and 17 above, and further in view of Nothnagel et al. (Human Heredity, Vol. 54, p. 186-198, 2003).

The claims are directed to software and computer implemented method for calculating linkage equilibrium and displaying the results in color. In some embodiments, an entropy value is calculated for the data and he entropy data used to reduce the number of loci to be processed.

Angius et al. in view of Abecasis et al. as applied to claims 1-3, 10-12, 16, and 17 above shows a software and computer implemented method of calculating and displaying the results of LD analysis in color.

Angius et al. in view of Abecasis et al. as applied to claims 1-3, 10-12, 16, and 17 above do not show the determination of an entropy value for the LD data that is used to reduce the number of loci to be processed.

Nothnagel et al. shows a multi-locus measure that directly describes the strength of LD between multiple loci. Nothnagel et al. shows an entropy value calculation for the LD data (p. 188, col. 1-2). Nothnagel et al. shows the measures of ε and ΔS combined allowed for the simultaneous assessment of strength and significance of LD (p. 194, col. 1). Nothnagel et al. shows that haplotype blocks can be determined using the entropy value (p. 188, col. 1). Nothnagel et al. shows that entropy is the proper measure to assess the non-order or degree of non-structure of a system (p. 188, col. 1). Nothnagel et al. shows the entropy value is given by the combinations major and minor allele frequencies (p. 188, col.1, eq.3). Nothnagel et al. shows the entropy value is used to determine haplotype blocks (p. 188, col. 2). Nothnagel et al. shows that the knowledge

of haplotype blocks is an important step for LD mapping because it will put research in a position to carry out potentially more powerful association studies with multi-locus haplotypes instead of using individual SNP loci (p. 187, col.1). Nothnagel et al. shows that the regions of LD as measured by the entropy calculation are verified by pairwise LD calculations (p. 191, col. 2-p. 192, col. 2 and comparing figs. 3 to 4). The comparison is suggestive that one could scan multiple loci using the entropy calculation of Nothnagel et al. to identify regions having LD and then calculate pairwise LD values for the loci in those regions. The net effect of doing so would reduce the number of loci to be processed. Nothnagel et al. suggests a map of haplotypes can be used to reduce the cost of genotyping if most of the genetic variation can be described by a minimum number of discriminating loci (p. 187, col. 1). Nothnagel et al. suggest that the entropy value can be used as the LD value (p. 188, col.2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LD analysis of Angius et al. in view of Abecasis et al. as applied to claims 1-3, 10-12, 16, and 17 above with the entropy based measure of LD of Nothnagel et al. because Nothnagel et al. shows the entropy value highlights the strength of LD in chromosomal regions providing a map that can be used to reduce the cost of genotyping if most of the genetic variation can be described by a minimum number of discriminating loci.

Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARLHEINZ R. SKOWRONEK whose telephone number is (571)272-9047. The examiner can normally be reached on Mon-Fri 8:00am-5:00pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marjorie A. Moran can be reached on (571) 272-0720. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

11 June 2008

/K. R. S./
Examiner, Art Unit 1631
/John S. Brusca/
Primary Examiner, Art Unit 1631